Standard Math Education
An examination of 4th graders' computational and problem-solving skills

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I undertook this investigation in order to evaluate the level of fourth graders' computational and problem-solving skills prior to, during, and at the conclusion of the first semester, in accordance with Indiana's *Academic Standards for Mathematics* [1]. In this study, students in an Indianapolis Public School were asked to participate in a semester long evaluation and observation. This investigation consisted of three components—a pretest, observations conducted throughout the semester, and a posttest. All participation was voluntary, and students and parents were informed of their right to discontinue involvement at any time without prejudice. I conducted this investigation in order to fulfill my honors college thesis requirement at Ball State University.

The first component was a fourth grade computation and problem-solving pretest based on Indiana's Academic Standards for Mathematics [1]. I designed the pretest with questions based on each substandard of the two academic standards being evaluated. There was a total of 22 questions in all, each one modeled on the example exercises outlined in Indiana's Academic Standards for Mathematics [1], which are based on the National Council of Teachers of Mathematics' *Principles and Standards for School Mathematics* [2]. The pretest was given within the first two weeks of the fall semester to gather baseline data about students' abilities for each delineated substandard. Students were encouraged to do their best, while skipping anything they found frustrating or incomprehensible. I stressed the fact that the results would not affect their grade or anything in their school environment so that students would not feel forced to guess. I was more interested in the actual knowledge base and mastery for each standard than their ability to take a test or to guess in order to appear knowledgeable.

The second major component consisted of daily observations throughout the

course of the semester. Each day during mathematics instruction, I kept with me a copy of the computation and problem-solving standards being evaluated in order to observe instances of standards mastery and progress. Mathematics instruction occurred every day in the classroom, and I used the observation sheet to document events relevant to mastery of the standards in this investigation.

The third and final component of this investigation was a posttest identical to the pretest, given in order to analyze skill progression over the semester. The posttest was given approximately 12 weeks after the pretest. These three components were then evaluated to help me investigate the effectiveness of standards based education in elementary school mathematics.

Statistically, this investigation yielded results demonstrating mastery for most computation standards, with little mastery for problem-solving standards. Students made significant gains on eight of the twelve computation standards. The most significant gain was 58% among the computation standards. Students made a significant gain on only one problem-solving standard, which involved knowing and using appropriate methods for estimating results of whole-number computations. The 64% increase for this standard was by far the most noteworthy, but there was minimal gain for one other problem-solving standard. For most of the problem-solving standards, the majority of students failed to record a response. This investigation provided substantial empirical data about the achievement on computational and problem-solving standards in an elementary classroom.

This investigation also provided me with new insight into the impact of standards on our educational system. It allowed me to evaluate the importance and effectiveness of standards in the elementary mathematics classroom. This study demonstrated the presence of standards in the classroom, whether or not the standards were directly instructed. This investigation also showed the importance of the correlation of the standards across the concepts and grade levels. I feel that this investigation proved that while standards may not be the perfect design for mathematics education, they do provide a framework for what educators should be teaching and what students should be learning. Everyone may not wholeheartedly agree with using standards as the educational foundation, but this investigation does demonstrate the worthiness of a standards based groundwork in the American education system.

References

[1] Indiana Department of Education, Indiana's Academic Standards for Mathematics, Indiana Department of Education, Indianapolis, IN (2000).

[2] National Council of Teachers of Mathematics, Principles and Standards for School Mathematics, National Council of Teachers of Mathematics, Reston, VA (2000).